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A theoretical model for the prediction of fingering in the flow upstream of a circular hydraulic jump ANDREAS CLASS, THOMAS SCHMIDT, Forschungszentrum Karlsruhe — Experiments and numerical simulations of a circular hydraulic jump in a liquid metal have indicated, under certain conditions, the presence of "fingering" in the high-speed region upstream of the jump location. Rather than proceeding in the usual thin sheet to the jump, the liquid forms radial fingers (rivulets) that transport fluid to the jump location. The phenomenon appears to be due to the reduced wettability of the substrate by the high-surface-tension liquid metal. A theoretical model for the formation of fingers is presented, based on the use of the Bernoulli and continuity equations to obtain the pressure and flow rate, respectively, in the fingers, and the assumption that the interface curvatures at the symmetry line between fingers are equal and opposite to yield constant pressure there, allowing the number of fingers to be determined. For a sufficiently wettable (contact angle of roughly $\pi/4$) substrate and low jet velocities, no fingering solutions exist. A similar treatment determines the transition point between fingers and the circular hydraulic jump. Comparisons with experiments and numerical simulations will be presented.

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